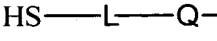
CLAIMS

1. An alkanethiol of formula (1) and the ~~enantimomers~~ of the alkanethiol of formula (1):



(1),

wherein -L- is $-(A_x-B_y-E_z-D)_w-$;

each A, B, E and D are individually $C(R_AR_A')$-, $-C(R_BR_B')$-, $-C(R_ER_E')$-,and $-C(R_DR_D')$-, respectively;

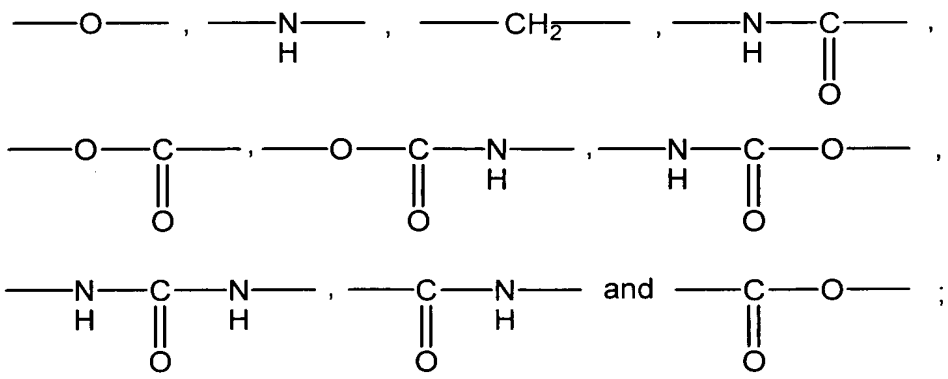
each R_A, R_B, R_E and R_D are individually H, or any two of R_A, R_B, R_E and R_D together form a bond, or R_A, R_B, R_E and R_D together with the atoms to which they are bonded form a six-membered aromatic ring;

each R_A', R_B', R_E' and R_D' are individually H, or any two of R_A', R_B', R_E' and R_D' together form a bond, or R_A', R_B', R_E' and R_D' together with the atoms to which they are bonded form a six-membered aromatic ring;

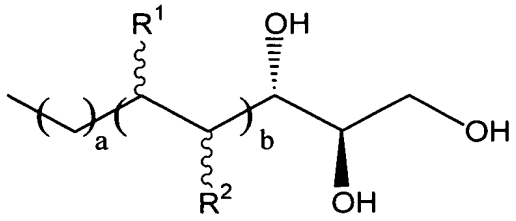
each x, y and z are individually either 0 or 1;

w is 1 to 5;

-Q- is selected from the group consisting of



-T is a moiety of formula (2)



(2);

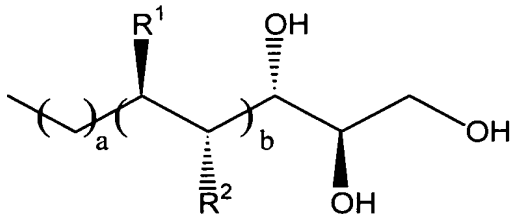
R^1 and R^2 are each individually selected from the group consisting of H and OH;

a is 0 to 3;

b is 0 to 3; and

~~~ indicates that the chirality of the carbon atom to which it is attached is either R or S.

2. The alkanethiol of claim 1, wherein -T is a moiety of formula (2')



(2').

3. The alkanethiol of claim 2, wherein a is 1, b is 1 and at least one of R^1 and R^2 is OH.

4. The alkanethiol of claim 2, wherein -L- contains 8 to 18 carbon atoms.

5. The alkanethiol of claim 4, wherein -L- contains 1 or 0 double bonds, or 1 triple bond.

6. The alkanethiol of claim 2, wherein -L- is an alkylene containing 6 to 18 carbon atoms.

7. The alkanethiol of claim 2, wherein -Q- is -O- or $-CH_2-$.

8. The alkanethiol of claim 3, wherein -L- is an alkylene containing 6 to 18 carbon atoms, and -Q- is -O-.

9. A disulfide of formula (3) and the ~~enantimomers~~ of the disulfide of formula (3):

T—Q—L—S—S—J (3),

wherein -L- is $-(A_x-B_y-E_z-D)_w-$;
~~~

each A, B, E and D are individually $C(R_AR_A')$-, $-C(R_BR_B')$-, $-C(R_ER_E')$-,and $-C(R_DR_D')$-, respectively;

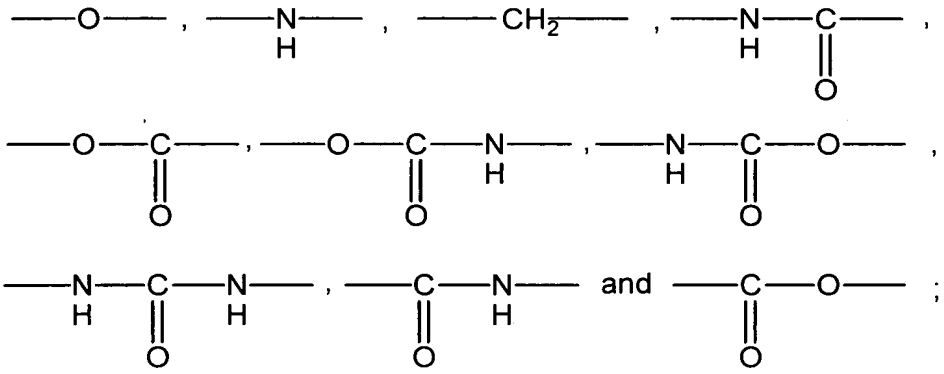
each R_A, R_B, R_E and R_D are individually H, or any two of R_A, R_B, R_E and R_D together form a bond, or R_A, R_B, R_E and R_D together with the atoms to which they are bonded form a six-membered aromatic ring;

each R_A', R_B', R_E' and R_D' are individually H, or any two of R_A', R_B', R_E' and R_D' together form a bond, or R_A', R_B', R_E' and R_D' together with the atoms to which they are bonded form a six-membered aromatic ring;

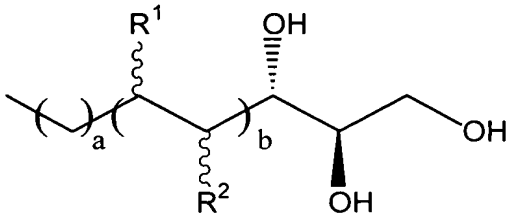
each x, y and z are individually either 0 or 1;

w is 1 to 5;

-Q- is selected from the group consisting of



-T is a moiety of formula (2)



(2);

R^1 and R^2 are each individually selected from the group consisting of H and OH;

a is 0 to 3;

b is 0 to 3;

∿∿∿ indicates that the chirality of the carbon atom to which it is attached is either R or S;

-J is selected from the group consisting of H, halogen, R, -OR, -NRR', -C(O)R, and -C(O)OR;

R is selected from the group consisting of alkyl, alkenyl, alkynyl, aryl and heterocyclic radical; and

R' is selected from the group consisting of H, alkyl, alkenyl, alkynyl, aryl and heterocyclic radical.

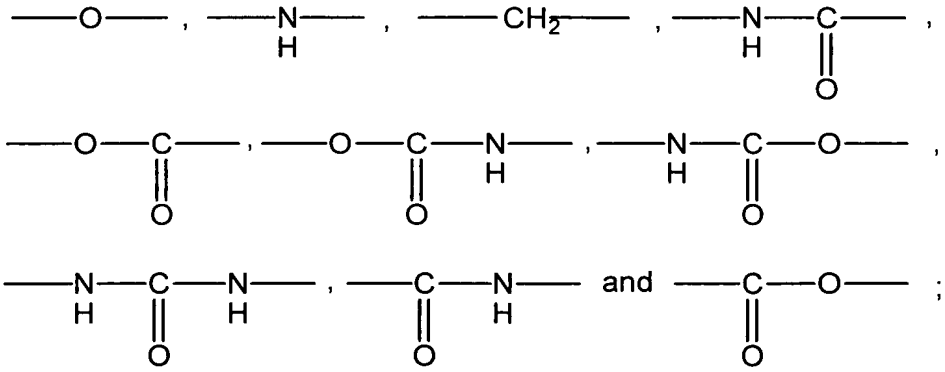
10. The disulfide of claim 9, wherein -J is a moiety of formula (4):

——L'——Q'——T' (4),

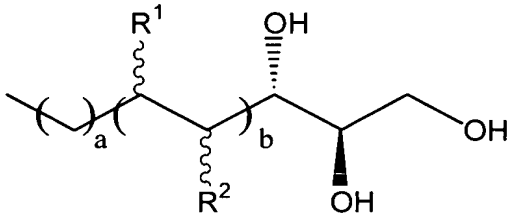
an alkyl having 1 to 4 carbon atoms, or $-(CH_2)_c(OCH_2CH_2)_nOH$; and

wherein -L'- is $-(A_x-B_y-E_z-D)_w-$;

-Q'- is selected from the group consisting of



-T' is a moiety of formula (2)



(2);

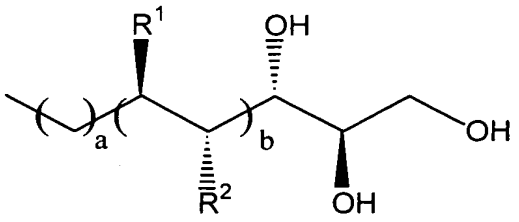
c is 2 to 20, and

n is 1 to 3.

11. The disulfide of claim 9, wherein -J is a moiety of formula (4'):

——L——Q——T (4').

12. The disulfide of claim 11, wherein -T is a moiety of formula (2')



(2').

13. The disulfide of claim 12, wherein a is 1, b is 1 and at least one of R^1 and R^2 is OH.

14. The disulfide of claim 12, wherein -L- contains 8 to 18 carbon atoms.

15. The disulfide of claim 14, wherein -L- contains 1 or 0 double bonds, or 1 triple bond.

16. The disulfide of claim 12, wherein -L- is an alkylene containing 6 to 18 carbon atoms.

17. The disulfide of claim 12, wherein -Q- is -O- or $-CH_2-$.

18. The disulfide of claim 13, wherein -L- is an alkylene containing 6 to 18 carbon atoms, and -Q- is -O-.

19. A substrate, comprising:

(i) a surface layer comprising gold, and

(ii) a plurality of moieties, on at least a portion of said surface layer,

wherein said moieties are alkanethiolate moieties of formula (5) and ~~enantimomers~~ of the alkanethiolate moieties of formula (5):

Surf——S——L——Q——T (5);

-L- is $-(A_x-B_y-E_z-D)_w-$;

each A, B, E and D are individually $C(R_AR_A')$-, $-C(R_BR_B')$-, $-C(R_ER_E')$-, and $-C(R_DR_D')$-, respectively;

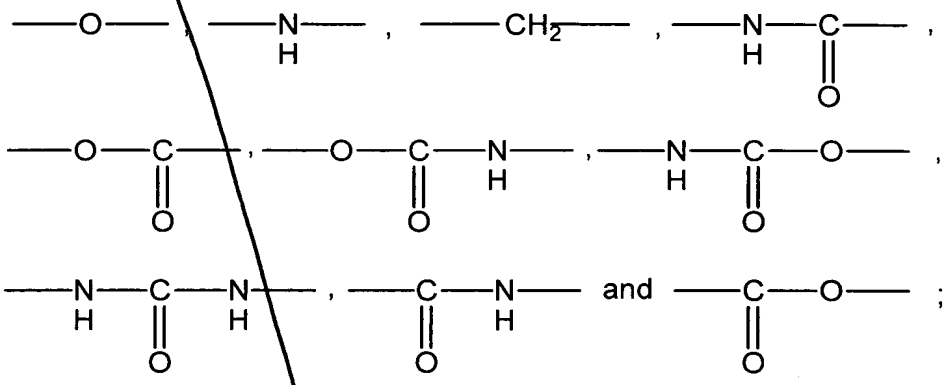
each R_A, R_B, R_E and R_D are individually H, or any two of R_A, R_B, R_E and R_D together form a bond, or R_A, R_B, R_E and R_D together with the atoms to which they are bonded form a six-membered aromatic ring;

each R_A', R_B', R_E' and R_D' are individually H, or any two of R_A', R_B', R_E' and R_D' together form a bond, or R_A', R_B', R_E' and R_D' together with the atoms to which they are bonded form a six-membered aromatic ring;

each x, y and z are individually either 0 or 1;

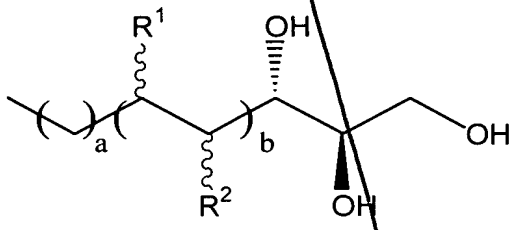
w is 1 to 5;

-Q- is selected from the group consisting of



; and

-T is a moiety of formula (2)



(2);

R^1 and R^2 are each individually selected from the group consisting of H and OH;

a is 0 to 3;

b is 0 to 3;

~~~ indicates that the chirality of the carbon atom to which it is attached is either R or S; and

Surf designates where the moiety attaches to said surface.

20. The substrate of claim 19, further comprising:
~~~

(iii) a monolayer comprising said moieties,

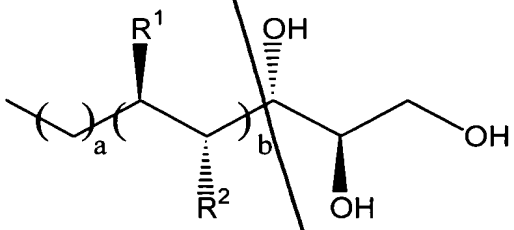
wherein said monolayer does not fail a cell patterning test at 12 days.

21. The substrate of claim 19, further comprising:

(iv) a base,

wherein said surface layer is on said base.

22. The substrate of claim 21, wherein -T is a moiety of formula (2')



(2').

23. The substrate of claim 22, wherein a is 1, b is 1 and at least one of R^1 and R^2 is OH.

24. The substrate of claim 22, wherein -L- contains 8 to 18 carbon atoms.

25. The substrate of claim 24, wherein -L- contains 1 or 0 double bonds, or 1 triple bond.

26. The substrate of claim 22, wherein -L- is an alkylene containing 6 to 18 carbon atoms.

27. The substrate of claim 22, wherein -Q- is -O- or $-CH_2-$.

28. The substrate of claim 23, wherein -L- is an alkylene containing 6 to 18 carbon atoms, and -Q- is -O-.

29. A substrate, comprising:

(i) a surface layer comprising gold, and

(ii) a monolayer comprising moieties, on at least a portion of said surface layer,

wherein said moieties are alkanethiolate moieties; and

said monolayer does not fail a cell patterning test at 12 days.

30. A cell chip, comprising:
(A) the substrate of claim 19, and
(B) cells, on said substrate.

31. A cell chip, comprising:
(A) the substrate of claim 20, and
(B) cells, on said substrate.

32. A cell chip, comprising:
(A) the substrate of claim 22, and
(B) cells, on said substrate.

33. A cell chip, comprising:
(A) the substrate of claim 24, and
(B) cells, on said substrate.

34. A cell chip, comprising:
(A) the substrate of claim 26, and
(B) cells, on said substrate.

35. A cell chip, comprising:
(A) the substrate of claim 28, and
(B) cells, on said substrate.

36. A cell chip, comprising:
(A) the substrate of claim 29, and
(B) cells, on said substrate.

37. A method of making the alkanethiol of claim 1, comprising: hydrolyzing a thioester, to form the alkanethiol of formula (1).

38. The method of claim 37, wherein said thioester contains OH groups protect with acetone.

39. A method of making the disulfide of claim 9, comprising:
oxidizing a first alkanethiol, to form the disulfide of formula (3).

40. The method of claim 39, further comprising oxidizing a second alkanethiol simultaneously with said first disulfide.

41. A method of making a substrate, comprising contacting a surface with the alkanethiol of claim 1;
wherein said surface comprises gold.

42. A method of making a substrate, comprising contacting a surface with the alkanethiol of claim 1;
wherein said surface comprises gold.

43. A method of making a substrate, comprising contacting a surface with the alkanethiol of claim 2;
wherein said surface comprises gold.

44. A method of making a substrate, comprising contacting a surface with the alkanethiol of claim 8;
wherein said surface comprises gold.

45. A method of making a substrate, comprising contacting a surface with the disulfide of claim 9;
wherein said surface comprises gold.

46. A method of making a substrate, comprising contacting a surface with the disulfide of claim 11;
wherein said surface comprises gold.

47. A method of making a substrate, comprising contacting a surface with the disulfide of claim 12;
wherein said surface comprises gold.

48. A method of making a substrate, comprising contacting a surface with the disulfide of claim 18;

wherein said surface comprises gold.

49. A method of making a cell chip, comprising:

contacting cells with the substrate of claim 19.

50. The method of claim 49, further comprising allowing said cells to proliferate.

51. A method of making a cell chip, comprising:

contacting cells with the substrate of claim 20.

52. The method of claim 51, further comprising allowing said cells to proliferate.

53. A method of making a cell chip, comprising:

contacting cells with the substrate of claim 22.

54. The method of claim 53, further comprising allowing said cells to proliferate.

55. A method of making a cell chip, comprising:

contacting cells with the substrate of claim 28.

56. The method of claim 55, further comprising allowing said cells to proliferate.

57. A method of making a cell chip, comprising:

contacting cells with the substrate of claim 29.

58. The method of claim 57, further comprising allowing said cells to proliferate.